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ABSTRACT

Vygotsky argued that children's development is most likely to occur when, in the course of collaboration, assistance is provided within their zone of proximal development--the distance between what a child can achieve independently and what he or she can do with the assistance of a more competent member of their culture. This paper reports the results of a study exploring the impact of providing feedback with or without a partner in order to ascertain whether feedback can create a zone of proximal development. Participants in the study consisted of 180 children aged from 6 to 8, drawn from 3 public elementary schools in Salt Lake City, serving predominantly European-American middle and lower middle class students. A subsample of 48 students was used based on their level of thinking regarding a balancing problem. Students were placed in three groups: no partner, partner of same level of thinking, and partner with a higher level of thinking. Half of the students received feedback and the other half did not. Results indicate students who received feedback achieved significantly higher on the posttest. Having a partner did not prove to be more beneficial than not having a partner. Collaboration with a partner was helpful when feedback was not provided. (AA)

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Feedback as a "zone of proximal development"

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Feedback as a "zone of proximal development"

Introduction

Vygotsky argued that children's development is most likely to occur when, in the course of collaboration, assistance is provided within their zone of proximal development--the distance between what a child can achieve independently and what he or she can do with the assistance of a more competent member of their culture (Vygotsky, 1987). Children do not "possess" zones, varying in dimension, but rather a zone may be created in the course of their collaboration with a more competent partner: "We propose that an essential feature of learning is that it creates the zone of proximal development; that is, learning awakens a variety of internal developmental processes that are able to operate only when the child is interacting with people in his environment and in cooperation with his peers" (Vygotsky, 1978, p. 90).

Vygotsky also used the concept of the zone of proximal development in a context in which children do not necessarily act in collaboration--"play creates a zone of proximal development of the child. In play a child always behaves beyond his average age, above his daily behavior" (Vygotsky, 1978, p. 102). Are there other situations in which children, alone, can be "stretched" and, as a consequence, show evidence of cognitive development? The research described here explored the impact of providing feedback with or without a partner in order to ascertain whether feedback can create a zone of proximal development.

Subjects and Methodology

Participants consisted of 180 children aged from six to eight, drawn from three public elementary schools in Salt Lake City. The majority of the children were white, and the schools served predominantly middle class and lower middle class neighborhoods. The children used Siegler's (1976) mathematical balance beam task; their responses to 14 problems indicated which of 5 different rules (levels of thinking) they used to predict the beam's working. (More rules can reliably be distinguished than the four that Siegler [1976] originally found. Full details of the rules may be found elsewhere [Tudge, 1989, 1991]). Target children were randomly designated and assigned to one of 3 conditions: to work with no partner, with an equally competent partner, or with a more competent partner. Partners were of the same age, gender, and classroom. Children in the paired conditions took turns to make predictions. In the event of disagreement in prediction, the children were asked to discuss their disagreement and come up with "just one answer." The experimenter (a white female) then left the room. All treatment sessions were videotaped.

My focus for this paper is on a subsample of 48 children, all of whom used Rule 2 at the time of the pretest--that is, they all only took number of weights into account when making their predictions, predicting that the beam would balance when the numbers of weights were equal or that it would tip to the side on which there were more weights. The mean age of this subsample was 6.78 (SD 0.76), of whom 20 were aged six, 19 were seven and 9 were eight. Slightly more than half were female (26), with 22 boys. In this subsample, 14 did not have a partner, 12 worked with a partner who had used the same rule at the time of the pretest, and 22 worked with a more competent partner, a child who took both number of weights and distance into account when the number of weights were equal. Half of the children received feedback and half did not. For the feedback group only, supports holding the beam in place were removed

after pairs reached agreement on their predictions (or the no-partner children made their predictions).

For the treatment sessions, four of the problems to be worked on could be solved by the target child's pretest rule (the child could refer simply to number of weights) but the remaining four featured problems in which equal numbers of weights were placed at different distances from the fulcrum. These latter problems were operationalized as being, potentially at least, within the child's zone of proximal development. There were two reasons for making this judgement. First, according to Siegler (1976), a reliance simply on number gives way, at about this age, to an understanding that distance is important when the numbers are equal. Second, according to Piaget, the ability to take two dimensions into account simultaneously should be developing in the age group used here.

Results

The results show the extent of improvement shown by the target children in two individual posttests, four days and three weeks after the paired session. Because the results did not vary significantly by age, gender, or any interactions by age or gender, the data were collapsed across these two variables. Analysis of Variance was used to determine whether differences between pretest and posttest rules used (with a score of 1 indicating use of the next highest rule, and so on) were related to whether or not children received feedback, their treatment condition (no partner, equally competent partner, or more competent partner), and the interaction of these two variables. The results show the independent effects of each variable, over and above any variance that is attributable to the other variables.

The effect of feedback. The effect of feedback was highly significant at both posttests (see Figure 1 and Table 1); target children who received feedback showed much improved performance four days following the treatment session (Feedback 2.29, SD = 0.75, No Feedback = 1.08, SD = 1.18, $F_{1,42}$ = 21.54, p <.0001) and again three weeks later (Feedback 2.37, SD = 0.82, No Feedback = 0.92, SD = 1.25, $F_{1,42}$ = 27.09, p <.0001), where a score of 1 indicates improvement of one rule (i.e., from Rule 2 to Rule 3) from pretest. Ignoring whether or not a child was paired, it is thus evident that the effects of simply seeing whether one's predictions were correct or not was highly beneficial to subsequent improvement in thinking on this task.

The effect of pairing. Surprisingly, having a partner (whether at the same level of competence or more competent) did not prove to be more beneficial than having no partner, at least as indicated by the main effect of treatment condition. This was true both at the first posttest ($F_{2,42}$ = 0.76, p >.4) and at the second posttest ($F_{2,42}$ = 1.04, p >.3). However, this lack of mean differences between treatment groups is disguising a significant interaction of Feedback by Treatment, which was significant at both the first posttest ($F_{2,42}$ = 3.36, p <.05) and at the second posttest ($F_{2,42}$ = 5.24, p <.01). As Table 2 and Figures 2 and 3 reveal, if children received feedback they consistently improved on their pretest score (irrespective of presence or type of partner), whereas collaboration with a partner was helpful when feedback was not provided. Children who neither received feedback nor had a partner with whom to discuss the problems showed no evidence of feedback.

Conclusion

The clearest findings reported here are (a) that receiving feedback from the materials during the treatment session was highly beneficial in terms of subsequent cognitive development as assessed by two individual posttests four

days and three weeks later, and (b) that having a partner proved more effective than working individually during the treatment session only for those children who did not receive feedback.

What are the implications for the concept of the zone of proximal development? At first glance, one might feel that these data cast doubt upon the value of the concept, at least as it relates to the effectiveness of peer collaboration, for these data indicate that it was at least as beneficial to work alone on the problems as to work with a partner--so long as feedback was provided. However, there are two caveats that must be considered. One has to do with the processes of collaboration, and the second has to do with nature of the "individual" treatment group.

The first caveat has to do with the processes of collaboration. It is clear that under conditions of feedback it is of no particular value to have a partner, even one who is more competent. Is this finding at odds with Vygotsky's position? I think not. It is important to guard against the fallacious notion that collaboration within the zone of proximal development is likely to occur any time two children, differing in terms of competence (or at least competent performance, as established in a pretest), are asked to work together on a problem. Collaboration involving the creation of a zone of proximal development requires that both participants share the goal of solving a problem or mastering a skill, and that they both discuss their differing ideas in such a way that the less competent partner is helped to reach a more advanced level of understanding of that problem. Partners may do many things in the course of interaction, at least some of which are unlikely to lead to a sharing of ideas at a more advanced level; instead of trying to solve a problem collaboratively, sharing ideas and working toward resolution of them, partners may actually hinder learning by diverting attention from the task at hand.

Analysis of the processes of interaction (see, for example, Tudge, 1991) reveals that collaboration in which the more competent partner explains his or her viewpoint in such a way that the less competent partner accepts the reasoning is highly predictive of development, as assessed by subsequent individual performance. By contrast, failure either to explain or to listen to the partner's arguments was not associated with development. The process of collaboration, it is clear, involves more than simply being asked to work with a partner.

The second caveat relates to the fact that there is a tendency, when conducting research comparing collaborative and individual problem solving, to view the "individual" treatment as being in some sense non-social--that the child, while working on the problem, is engaged in purely individual activity. This view fits well with a Piagetian analysis, in which one mechanism fostering cognitive development is held to be discrepancy between the child's initial attempts to make sense of the physical environment and features of that environment. It is in this sense that one can understand the prevalence of the metaphor of "the child as scientist," working on problems in splendid isolation. Although Piaget concerned himself to some extent with the effects of social interaction on cognitive and moral development (for more detail, see Tudge & Winterhoff, 1991), despite his use of the "clinical method" to discover the nature of young children's thinking Piaget seemed to view himself not as the child's social partner but as a data-gathering instrument. By contrast, from a Vygotskian perspective there is no validity to the view that a child who is working alone is engaged in non-social activity.

In the study under consideration, the materials, the task, and the school setting in which the research took place are all defined by their

social, cultural, and historical contexts. Children in the "no partner" condition were working on a school-like task, in a school setting, with an adult experimenter who set up each problems, asked for the children's predictions, and recorded the responses. In Vygotskian terms, this hardly qualifies as a "non-social" experience. No matter how much we would like to view the experimenter's presence as not relevant to the overall situation, the experimenter is necessarily part of the child's immediate social context. In the present study, it is not unlikely that the experimenter's presence may have served to keep the child more focused that might otherwise have been the case, particularly in comparison to the paired treatment conditions, when she left the room while the pair members discussed their disagreement.

In a situation in which a child is implicitly encouraged to remain focused on the task by the adult's presence, feedback from the materials alone may be enough to foster development, particularly when the problems are geared to be just in advance of the child's current level of thinking. Moreover, as Wertsch (1991) has eloquently argued, Bakhtin's account of dialogue with oneself or with an absent social partner, is in itself an invocation of a social partner. Vygotsky himself discussed this phenomenon when describing the processes whereby external speech (for others) becomes internal speech (for oneself), and when a teacher, having helped a child understand a problem in a new way, remains "invisibly present" when the child solves the problem alone (Vygotsky, 1987, p. 216).

Feedback, when geared slightly in advance of the child's initial performance, had a significant effect on development both with and without a partner. In the absence of a partner, this type of school-like task, worked on in the presence of an adult, with problems that were chosen to be slightly in advance of the child's pretest level clearly led to improvement when feedback was also provided, but did not in the absence of feedback. These results support the idea that feedback can indeed be considered a zone of proximal development--at least in the social context that characterized this research.

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Table 1: The impact of feedback*

Condition	Mean	SD	N
1st Posttest			
Feedback	2.29	0.75	24
No feedback	1.08	1.18	24
2nd Posttest			
Feedback	2.37	0.82	24
No feedback	0.92	1.25	24

*Results expressed as a change from pretest score, where 1 signifies an improvement of one rule.

Table 2: The impact of presence and competence of a partner*

Condition	Mean	SD	N
With feedback			
No partner			
1st posttest	2.57	0.53	7
2nd posttest	2.86	0.38	7
Partner equally competent			
1st posttest	2.33	0.52	6
2nd posttest	1.83	1.17	6
Partner more competent			
1st posttest	2.09	0.94	11
2nd posttest	2.36	0.67	11
Without feedback			
No partner			
1st posttest	0.29	0.49	7
2nd posttest	0	0	7
Partner equally competent			
1st posttest	1.33	1.21	6
2nd posttest	1.17	1.33	6
Partner more competent			
1st posttest	1.45	1.29	11
2nd posttest	1.36	1.36	11

*Results expressed as a change from pretest score, where 1 signifies an improvement of one rule.

Figure 1: The Impact of Feedback

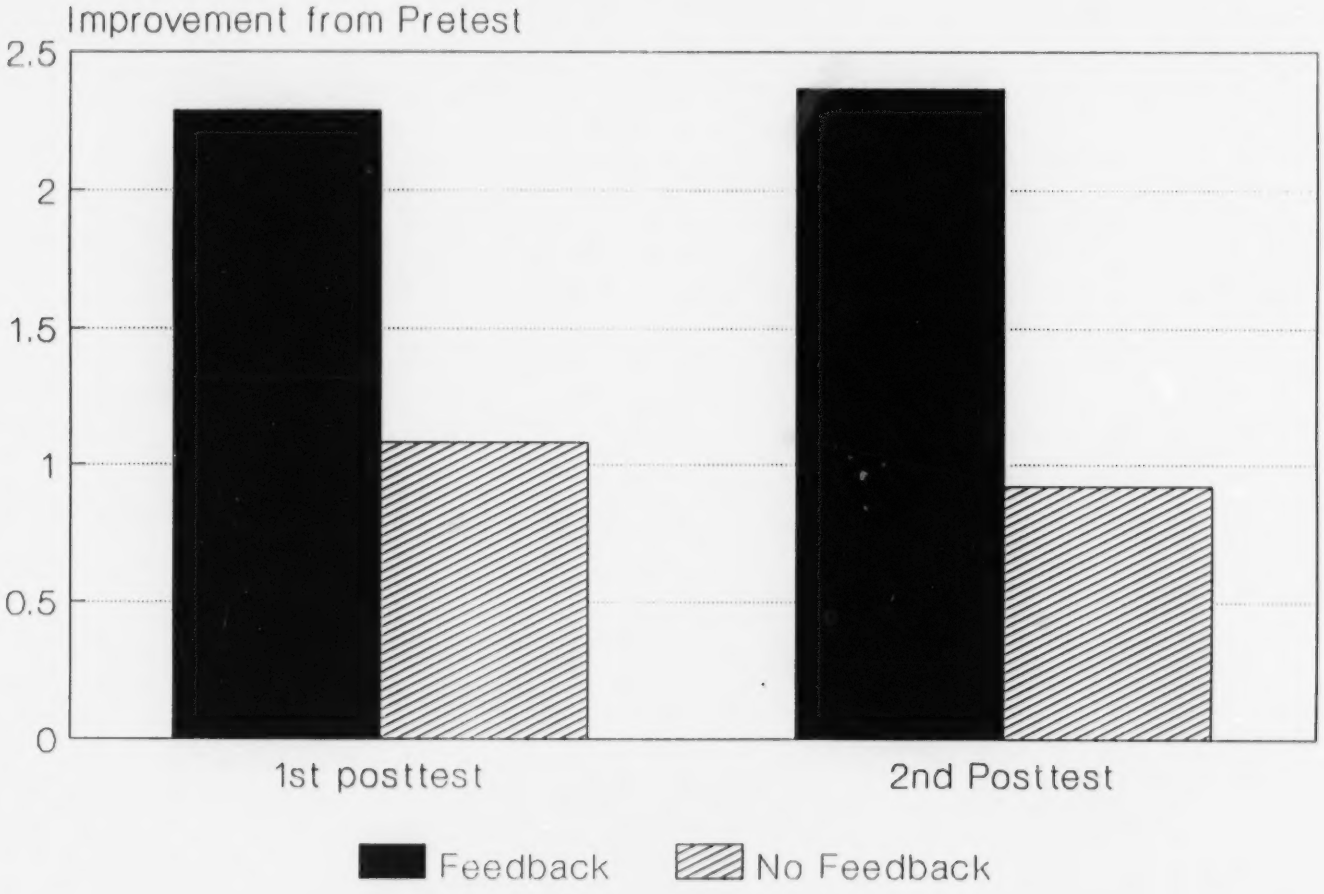


Figure 2: Feedback by Pairing
1st Posttest

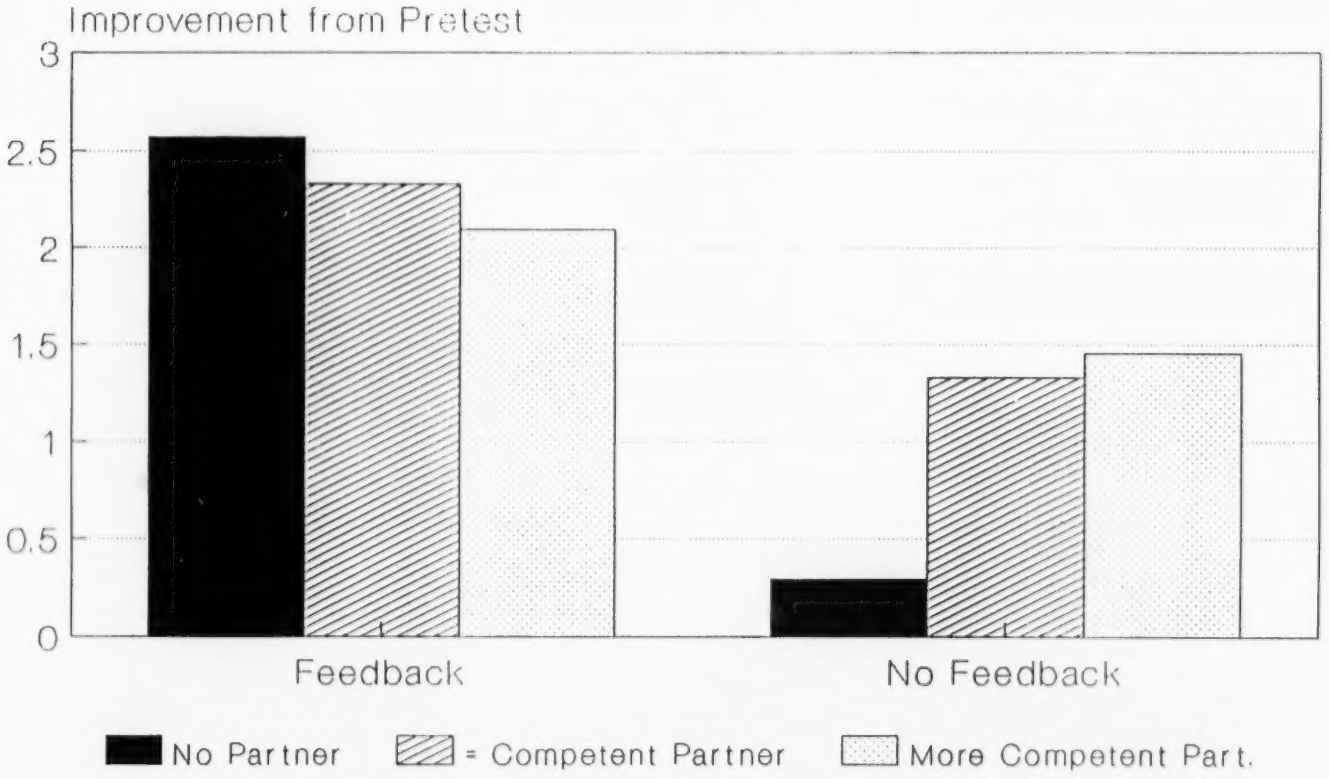
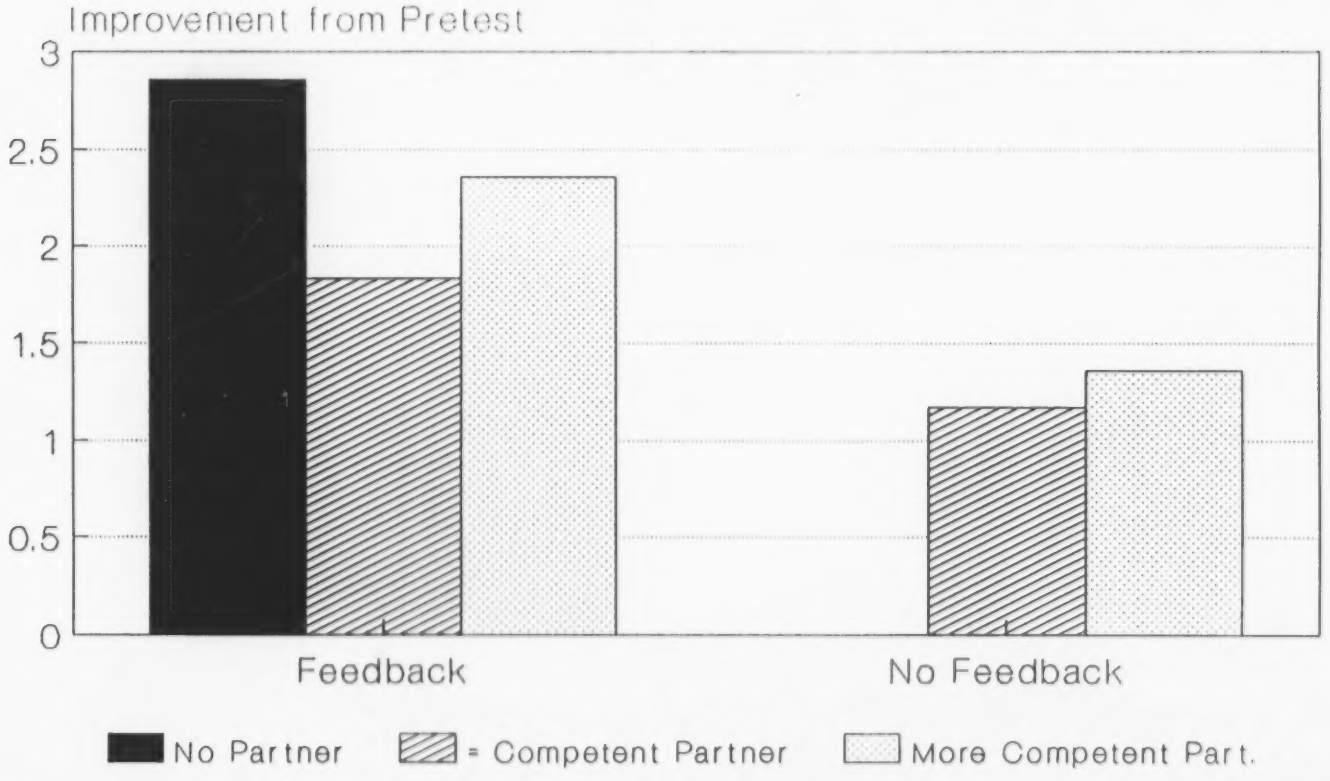


Figure 3: Feedback by Pairing
2nd Posttest



Date _____

CDF 346
Evaluation of Presentation and Paper

Topic _____

Presenters 1_____(__) 2_____(__)

3_____(__) 4_____(__) 5_____(__)

6_____(__) 7_____(__) 8_____(__)

Group Presentation

	Poor			Good				Excellent			
Group Planning and Participation	1	2	3	4	5	6	7	8	9	10	.....
Informativeness	1	2	3	4	5	6	7	8	9	10	.....
Clarity / Creativity	1	2	3	4	5	6	7	8	9	10	.....
Cohesiveness	1	2	3	4	5	6	7	8	9	10	.....
Written Work (Handout)	1	2	3	4	5	6	7	8	9	10	.....

Sub-total _____ /50

Individual Paper

	Poor			Good				Excellent			
Relevance	1	2	3	4	5	6	7	8	9	10	.....
Informativeness	1	2	3	4	5	6	7	8	9	10	.....
Organization / Clarity.....	1	2	3	4	5	6	7	8	9	10	.....
Grammar / Spelling	1	2	3	4	5	6	7	8	9	10	.....
References	1	2	3	4	5	6	7	8	9	10	.....

Sub-total _____/50

Total Points_____ /100

Points Range
90 - 100 = A; 80 - 89 = B; 70 - 79 = C; 60 - 69 = D; 59 & Below = F

Notes:
In alphabetical order, fill in the names of your group members in the spaces at the top of the form and circle your own name.

Rate all group members' participation, including your own, on a scale from 1 to 3. Use the criteria listed below, and write the number in the parentheses beside the name.

3 - excellent (participated in all group planning meetings, assumed full responsibility for share of work, and completed it on time)
2 - good (attended most meetings, contributed adequately to group planning, and did work)
1 - poor (didn't attend or didn't participate in group work, late in doing share of work)

Staple this form to the back of your paper. This form will be used by the instructor to rate your individual paper and the group presentation.